Environmental Biomarkers and the Health of Ecosystems

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Keywords: genomics, microarrays, computational, toxicology

Biomarkers comprise biomolecular entities that indicate such things as individual identity, presence of disease, individual sensitivity to particular stressors, individual exposure to particular stressors, and/or the level of effect of one or more stressors on individual health. The biomolecular entities that may be quantified include DNA (the genome), mRNA (the transcriptome), proteins (the proteome) and metabolic products. Various techniques have been used to obtain and quantify biomarkers in non-human components of the environment, including reporter cell lines, antibody-based assays, and gel electrophoretic techniques. These and other advances in high-throughput gene and protein expression analysis are permitting computational analysis of biological complexity from a systems level perspective. These tools and techniques provide a potentially revolutionary capability for rapid, multidimensional assessment of biomarkers in environmental applications. This paper will provide an overview of some of the most promising technologies and review recent biomarker research at the Pacific Northwest National Laboratory focused on applications for Pacific Northwest environmental issues.